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DOD USE OF COMMERCIAL WIDEBAND SATELLITE COMMUNICATIONS SYSTEMS:

HOW MUCH IS NEEDED, AND HOW DO WE GET IT?

by

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Preface

I chose this subject for my research project because, during my 13 year Air Force career, I have planned communications support and deployed on contingency operations and exercises throughout Europe and Southwest Asia, and I have always wished for more bandwidth to support our customers. From my experience on a MAJCOM staff and in a combat communications squadron, I see how big the gap is between our organic military satellite communications capabilities and the ever-expanding requirements of the high-tech systems supporting warfighters today. This paper is written for the general DoD member, military or civilian, who would like to better understand this issue.

I greatly appreciate the superior support I received from my research advisor, Major Kim Olson. Her dedication to helping me succeed in this endeavor, in light of her already heavy day-to-day workload, was outstanding. I would also like to thank the men and women of United States Space Command's Global SATCOM Support Center at Peterson Air Force Base, Colorado, especially SSgt Sundseth, who spent many hours providing me detailed information, and was an outstanding tour guide during my visit.

Abstract

Joint force commanders must have the right information at the right time in order to make the best decisions to conduct successful contingency operations in defense of U.S. national security interests. A key enabler to this end is sufficient wideband satellite communications connectivity. DoD's organic wideband satellite communications capabilities are inadequate, so commercial services must be used to overcome the shortfall. The problem is to dedicate enough resources in the most efficient manner to meet this growing need, and time is of the essence.

This paper capitalizes on the vast work already accomplished concerning what DoD needs to do to obtain the commercial wideband satellite communications it needs. DoD is procuring advanced satellite ground terminals capable of using commercial wideband satellites and is contracting to launch more of its own capabilities, but the gap is continuing to widen. This paper offers a solution of procuring 140 percent of DoD's projected wideband satellite communications from commercial sources, to ensure sufficient capacity is available to support contingency operations.

A dedicated, concerted focus toward correcting this problem by senior DoD leaders is critical regarding this issue. Likewise, innovative approaches toward gaining commercial satellite communications must be funded without exception. A key requirement to make this happen is the designation of a single office or organization to oversee the processes and ensure DoD requirements are met in the most efficient and effective manner possible. As important as effective communications capability is to the joint force commander, wideband satellite

communications cannot be allowed to be a limiting factor in the ability to plan and conduct his military operations.

Chapter 1

Full Spectrum Dominance

> *…the continued development and proliferation of information technologies will substantially change the conduct of military operations. These changes in the information environment make information superiority a key enabler…*
>
> —Joint Vision 2020[1]

It was 0100Z, March 7th, 2011, and CNN Headline News has just reported the United States Embassy in Islamabad, Pakistan, had suffered what appeared to be a terrorist attack and the number of casualties had yet to be determined. Over the next few hours the scene unfolded as more and more detail was learned about this asymmetrical attack against the United States. Dr. Jack Thompson, US Ambassador to Pakistan, sent digital pictures of the damage back to the State Department using his SIPRNET link, casualty and damage reports via secure e-mail, and participated in a secure VTC with the Secretary of State, Secretary of Defense, and CJCS. Following the VTC, the SECDEF directed CJCS to develop recommendations on how to increase the security of the embassy, evacuate American citizens in the country, and determine what organization was responsible for the attack. The Chairman was given 6 hours to accomplish this and then brief his recommendations to the NSC at a meeting scheduled for 1000Z.

One hour later, following a phone call from the NMCC, USCINCCENT activated his CAT and courses of action were discussed. A Navy carrier battle group was in the area on its way to

support Operation SOUTHERN WATCH, and there was a joint CENTAF/SOCCENT exercise being conducted in Oman. Additionally, a B-2 had just departed Missouri on a long-range, live-fire training mission toward Europe. CENTCOM/J6 confirmed that the CENTCOM Operations Center had reliable, secure communications with command elements of the CVBG, the C/JSOTF in Oman, and the B-2 via ACC's Operations Center. The staff developed courses of action, and 3 hours later CINCCENT called CJCS and provided his recommendations via his secure desktop VTC.

Based on the CJCS's pre-brief, SECDEF authorized release of a warning order to CENTCOM, EUCOM, JFCOM, SOCOM, and TRANSCOM (info copy to PACOM, SPACECOM, SOUTHCOM, and STRATCOM), to prepare to execute operations to resolve this crisis. At precisely 1005Z, the NSC convened, and 25 minutes later the President authorized implementation of the course of action briefed by the CJCS. Operation QUICK SNAP was set in motion.

The combatant commanders received the execution order at 1050Z, and everyone delegated OPCON of their appropriate forces to the JSOTF commander in Oman, whom the SECDEF had designated the JFC for this operation. JFCOM only delegated TACON of the enroute B-2 to the JSOTF. Colonel Bob McMahan, commanding the JSOTF, ordered Navy UAVs from the CVBG to begin conducting surveillance operations over the Islamabad area, and simultaneously tasked his J2 to query the national intelligence community for additional real time information in the area, including the B-2 target area in Afghanistan. The intelligence community had been able to determine the terrorist attack on the embassy had been ordered by Oussama bin Laden, whose Afghanistan headquarters had been recently located by Israeli intelligence agents and confirmed by GCC sources. McMahan also tasked his JFACC to coordinate with the CVBG to provide

EA-6B EW support for the enroute B-2 bomber, which would be conducting its strike mission in approximately 12 hours. As Major John Grant changed his B-2's flight plan, he received a call from Lt Col Mike Wheeler, the JSOTF JFACC, who briefly outlined the situation. Wheeler then ensured Grant was receiving a good BatPic feed, including full-motion satellite video of the ingress/egress route being planned by the EA-6B mission leader.

As Major Matt Byrd finished developing his plan for elements of his 75th Ranger Regiment unit to conduct the NEO, including coordinating with the CV-22 lead pilot and the AC-130 gunship commander, Colonel McMahan called Ambassador Thompson on his STE and told him the scope of the operation. Meanwhile, Wheeler finished coordinating aerial refueling service for the B-2, the EA-6B and F-14 escort package, and the CV-22 and AC-130 flight.

Out in the Gulf of Oman the two Naval air packages launched to execute their portions of the mission. The F-14 fighters escorting the CV-22s and AC-130 met them as they crossed into Pakistani air space and proceeded to Islamabad to conduct the NEO. About an hour later, after refueling, the pair of EA-6Bs and flight of four F-14s began blazing a trail for the B-2 following close on their heels. An AWACS on loan from JTF-SWA was controlling all flight operations. Video and flight data from each aircraft, plus feeds from the orbiting UAV and embassy security cameras, and overhead surveillance information, was being integrated into the overall BatPic so that each operations center and aircrew was fully aware of the battlespace situation across the full spectrum of the operation. Maj Byrd and each of his Rangers were also receiving the BatPic on their SDDs.

At 2300Z on March 9th, CNN Headline News reported that the U.S. military had successfully evacuated 43 American citizens from Pakistan, including the Ambassador. One

week later CNN reported that sources in the middle east were reporting that Oussama bin Laden had recently died from a terminal illness that had long been kept secret.

In order to maintain the realism of this scenario, acronyms are not explained to reflect the flow of normal spoken language. Definitions for each acronym are provided in the glossary.

Problem Statement

The previous scenario is an entirely fictional scenario. It does, however, provide an accurate view of how important integrated, high-capacity communications are to conducting military operations in the future. This is not only a prediction of the future, but is also true today. In *Joint Vision 2020*, General Shelton, Chairman, Joint Chiefs of Staff (CJCS), outlined the Department of Defense's (DoD) need to achieve full spectrum dominance.[2] Vital to this effort are fully interoperable sensors of all types, on all platforms, and well-integrated processes to use the information provided by these tools. A key enabler to this whole quest and a foundational, overarching element in the effort is a global information system that seamlessly weaves these capabilities together. This global communications system, sometimes called the global information grid (GIG), is absolutely required before the DoD can achieve the key enabler known as information superiority.[3]

To achieve information superiority, the U.S. military must provide a common communications transport capability that fully connects all users--in essence, a military "intranet." Foundational to this is the need to electronically connect military organizations, especially those forward deployed conducting contingency missions such as the one described above, to provide military decision makers the right information at the right time, in the right format to help them make the best decisions.

This paper will examine one key part of the communications connectivity puzzle, namely wideband satellite communications. The subject is further limited to the simple question of how DoD can use commercial satellite communications capabilities to help build an U.S. military intranet that will support the warfighter of today and tomorrow.

The second focus of this paper is the apparent lack of a single leader or organization to oversee the process of satisfying DoD's wideband satellite communications requirements. This problem causes a lack of unity of effort, one of the most important facets of effective military operations, especially given budget limitations. The question is how should DoD organize, and more specifically, which single entity should be in charge to ensure DoD uses commercial satellite communications as efficiently and effectively as possible.

Problem Significance

Today's DoD satellite communications capability is overwhelmed, unable to support its deployed warfighters with sufficient military-owned wideband communications services to meet their requirements. It has been estimated that between 1998-2007 civil, commercial, and military interests will spend over $500 billion to launch approximately 1,000 new satellites into orbit, most of them communications-related.[4] Additionally, "…potential adversaries will have access to the global commercial industrial base and much of the same technology as the U.S. military…Increased availability of commercial satellites, digital communications, and the public internet all give adversaries new capabilities at a relative low cost."[5] These capabilities increase the threat of adversaries conducting asymmetrical attacks against U.S. targets. To help counter this threat, given the continuous improvements being made in the information technology field, of which satellite communications is just a small part, it is absolutely necessary for DoD to

commit sufficient resources to ensure its warfighters “maintain the high ground” that has been so important for military success throughout the history of armed conflict.

This paper will examine how commercial sector capabilities can be leveraged to help meet DoD’s wideband satellite communications shortfalls. Further it will discuss some broad, high-level impediments to warfighters receiving the communications services they need to successfully accomplish their missions, and suggest ways to mitigate these problems.

Study Limitations

This study is confined to the specific area of wideband satellite communications and how commercial services of this type may be used to satisfy some U.S. military requirements. This study will also consider some related process and organizational issues. Examples are used to indicate the ability of current and projected programs to satisfy the communications requirements of the deployed warfighter conducting contingency operations.

Historical Context

Just as powered aircraft technology has progressed at a rapid rate since its beginnings at Kitty Hawk with the Wright brothers in 1903 to the new F-22 Raptor fighter, satellite technology has advanced quickly, perhaps even exponentially.[6] Communications satellite technology alone is not even 45 years old, yet its progress has been nonstop and its importance to the DoD is unquestionable.

In December, 1958, an orbiting satellite broadcast the first communications from space, a Christmas message from President Eisenhower. The Project Score satellite continued to receive and rebroadcast voice and teletype messages for another 12 days.[7] The first television picture broadcast from a satellite happened in 1959, and in 1963 Hughes Corporation placed the world’s

first geosynchronous satellite in orbit.[8] In 1971 the United States launched the first Defense Satellite Communications System (DSCS) Phase II satellites into geosynchronous orbit, followed in 1978 with the completion of the full four-satellite DSCS II constellation.[9]

Commercial satellite communications were used by the U.S. military during the Vietnam War when ten circuits between Bangkok and Hawaii were leased from the Communications Satellite Corporation.[10] "Satellites were the single most important factor that enabled USCENTCOM to build the command, control, and communications network of DESERT STORM."[11] During Operation ALLIED FORCE, the satellite communications bandwidth requirements were five times that used during DESERT STORM in 1991.[12] As of May 2000, there were 2,671 satellites in orbit, approximately 10 percent of which are commercial communications satellites in geostationary orbit.[13]

Methodology

The scope of this project is limited to the discussion of two key issues. First, current and planned DoD and commercial wideband communications satellite capabilities and initiatives are discussed, including suggestions for procuring more capabilities to meet DoD requirements. The second discussion is the issue of DoD organizational structure with respect to the subject.

Notes

[1]*Joint Vision 2020: America's Military: Preparing for Tomorrow*, (Washington, D.C.: Office of the Joint Chiefs of Staff), 3.

[2]Ibid., 3.

[3]Ibid., 2.

[4]Gen Howell M. Estes III, *USSPACECOM Long Range Plan*, (United States Space Command, March 1998, available from http://www.peterson.af.mil/usspace/LRP.htm), 5.

[5]*Joint Vision 2020*, 4.

[6]Carroll V. Glines, Harry M. Zubkoff, F.Clinton Berry, Jr., *Flights: American Aerospace…Beginning to Future*, (Community Communications, Montgomery AL, 1994), 4; "F-22 Air Dominance Fighter" description, available from http://www.af.mil/news/Apr1997/f22/.

Notes

[7]*Air Force Magazine, USAF Space Almanac*, August 2000, 46.

[8]Ibid., 56.

[9]Ibid., 57.

[10]David N. Spires*, Beyond Horizons: A Half Century of Air Force Space Leadership*, (Air Force Space Command in association with Air University Press, 1998), 171.

[11]General Colin Powell, CJCS, from the 1992 *National Military Strategy*, as quoted by Major Ricky B. Kelly in "Centralized Control of Space: The Use of Space Forces by a Joint Force Commander," (Maxwell AFB, Ala.: School of Advanced Airpower Studies, 28 Jun 1993), 19.

[12]John A. Tirpak, "The Fight for Space," *Air Force Magazine, USAF Space Almanac*, August 2000, 64.

[13]*Air Force Magazine, USAF Space Almanac*, August 2000, 34; Defense Information Systems Agency briefing, "Commercial Satellite Communications: FY 2001 Overview," undated, 2.

Chapter 2

Military Wideband Satellite Communications

When asked, "Who do you consider to be the greatest generals?" He responded saying, "The victors."

—Napolean Bonaparte

Current Wideband Satellite Systems

The DoD currently owns and operates a variety of communications satellites, two of which are the mainstay for supporting two-way wideband satellite communications to deployed warfighters. These two types are the Defense Satellite Communications System (DSCS) and the Milstar Satellite Communications Systems, pictured below.


Figure 1 - DSCS III and Milstar Satellites[1]

The Air Force began launching DSCS III satellites in 1982, and currently operates 10 systems on orbit. Additionally, Lockheed Martin has upgraded a few DSCS satellites under the system life enhancement program (SLEP) and the Air Force began placing those systems in orbit last year. Each DSCS SLEP satellite costs $200 million. The DSCS constellation is DoD's

backbone wideband system supporting its deployed warfighter forces. Operating in the X-band frequency range, these satellites provide long-distance links up to approximately 2 Mbps each and have a projected lifespan of approximately 10-15 years.[2]

A total of six Milstar satellites were planned, with the first two placed in orbit in 1994 and 1995. These systems provide wideband satellite communications that are more jam resistant than the DSCS equipment, providing more assured service in hostile electronic warfare environments. Additionally, the Milstar systems are more than just "bent-pipe" satellites, unlike most other communications satellites. Bent-pipe satellites simply receive and retransmit signals, without and processing taking place. Milstar satellites actually process the communications signals, and are able to cross-link to other Milstar satellites to provide greater service to its users. A third Milstar satellite was lost following launch in 1999.[3]

Planned Wideband Satellite Systems

As the DSCS III and Milstar systems are unable to keep up with the growing DoD demand for wideband communications for deployed contingency operations, the military has begun two new programs to try to plug this gap between available capacity and ever-increasing demand. These programs are the Advanced Extremely High Frequency (AEHF) program, and the Wideband Gapfiller System (WGS) program.

Lockheed Martin, TRW, and Hughes compose a team currently developing the AEHF Satellite Communications System, which will be the successor to the Milstar program. The first system is planned for launch in 2004, with a total of four planned for the constellation.[4] An artist's rendition of an AEHF satellite is shown below.

On January 3, 2001, DoD announced the award of a $160 million contract to Boeing to begin work on the Wideband Gapfiller System (WGS). The WGS is being designed to bridge

the gap between the current DSCS satellites and an advanced wideband system, planned for 2008. The first of three WGS satellites is planned for launch in 2004, with an option for a total of six.[5] A drawing of a WGS satellite is shown below.

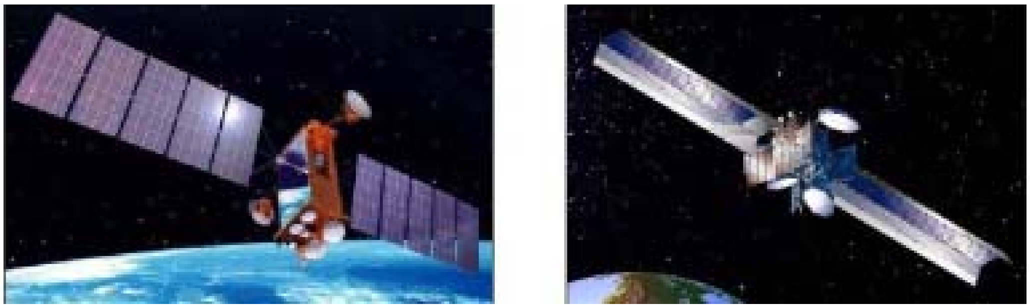

Figure 2 - AEHF and WGS Satellites[6]

Limitations of Current and Future Military Wideband Satellites

As has already been stated, the current DSCS and Milstar satellite systems cannot fully support the wideband satellite requirements in today's contingency operations. Neither will the AEHF and WGS satellites be able to keep up with future requirements.

A recent RAND study indicates that DoD wideband communications requirements will grow from 1 Gbps in 2000, to upwards of 9 Gbps in 2008, without considering surge requirements during contingency operations. When these projected surge requirements are added, total demand in 2008 jumps to about 13 Gbps.[7] Other experts estimate the requirement to be even higher.

According to a report prepared for the Defense Science Board, it is estimated that in the year 2010 "a total DoD communication capacity requirement of 35 Gbps for 2 MTWs [Major Theater Wars]."[8] In fact, that same report refers to another study completed for the Joint Chiefs of Staff J6 placing two-MTW requirements as high as 100 Gbps in the same time frame.[9] Considering these estimates, even with the AEHF and WGS systems online, total military wideband satellite

communications capacity is only expected to grow to a maximum of 4 Gbps, leaving a great shortfall.[10]

However, today's commercial satellite communications systems supply between 200-250 Gbps of wideband capacity to commercial and governmental users worldwide, with an expected growth to almost 1,000 Gbps by 2006.[11] DoD must determine whether or not these systems are the right choice to help satisfy its requirements.

Notes

[1]Air Force Space Command Fact Sheets, available from http://www.peterson.af.mil/hqafspc/library/facts; Hughes Space Corporation Press Release, available from http://www.hsc.com/hsc_pressreleases/photogallery/xm01/xmphoto.html.

[2]*Air Force Magazine, USAF Space Almanac*, August 2000, 47; Air Force Space Command Fact Sheet; available from http://www.peterson.af.mil/hqafspc/library/facts/dscs.html.

[3]Ibid., 47; Air Force Space Command Fact Sheet, available from http://www.peterson.af.mil/hqafspc/library/facts/milstar.html.

[4]Ibid., 47; "Lockheed Martin, Hughes and TRW combine strengths to form Advanced EHF National Team for U.S. Air Force," May 30, 2000 news release, available from http://www.lockheedmartin.com/news/articles/053000_1.html.

[5]"Boeing-Led Team Awarded $160 Million U.S. Military Communications Satellite Contract: Wideband Gapfiller Satellite Program Will Bridge Existing and Planned Systems," Jan 3, 2001, available from http://www.boeing.com/satellite/ ; *Air Force Magazine, USAF Space Almanac*, August 2000, 48.

[6]AEHF picture available from http://lmms.external.lmco.com/photos/military_space/advanced_ehf/advanced_ehf.html; WGS picture available from http://www.hsc.com/hsc_pressreleases/photogallery/xm01/xmphoto.html.

[7]Tim Bonds, et al, *Employing Commercial Satellite Communications: Wideband Investment Options for the Department of Defense*, (RAND, 2000), xvi.

[8]Dr. Michael S. Frankel, *Report of the Defense Science Board Task Force on Tactical Battlefield Communications*, February 2000, available from http://stinet.dtic.mil/cgi-bin/fulcrum_main.pl, 49.

[9]Ibid., 49.

[10]Tim Bonds, et al, *Employing Commercial Satellite Communications: Wideband Investment Options for the Department of Defense*, (RAND, 2000), xvi.

[11]Ibid., xvii, 27.

Chapter 3

Commercial Wideband Satellite Communications

> *The Department of Defense uses commercial (satellite communications) services on a daily basis. However, it often procures these services on an ad hoc basis rather than integrating them into its space architecture planning process because of a concern over potential unavailability in a crisis situation.*
>
> —2001 Space Commission Report[1]

The "Hurdle"

There is little debate that the DoD must turn to the commercial marketplace to obtain the additional wideband satellite communications services required to meet the total needs of the deployed warfighter. The basic question, however, is how to do so in the most cost efficient manner, given the unpredictable nature and frequency of contingency military operations. DoD continues to approach the problem as it always has, in an incremental, shortsighted manner. What is needed is a completely innovative, revolutionary approach--a paradigm shift. A February 2000 report to the Defense Science board stated,

> Unfortunately, the MilSatCom procurement strategy is directed towards the reprocurement of several military-unique systems with modest enhancements to its twenty-year old systems. This activity will consume $10 Billion of procurement funds over the next ten years, and nearly an equal amount of operations and maintenance (O&M) funds as well. Again, this is an approach founded on doing business as DoD has done in the past.[2]

As the commercial satellite communications industry continues to design and build more technologically advanced systems, and offer those capabilities to whoever is willing to pay for

them, U.S. national security becomes more and more threatened. "The U.S. Government, as a consumer, a regulator or an investor, is currently not a good partner to the national security space industry," according to the recent Space Commission Report, and this hurdle must be jumped.[3]

Can DoD Use Commercial Services on a Large Scale?

Historically, DoD has focused its efforts on meeting its contingency wideband satellite communications needs by using its organic capabilities. However, in almost all cases, requirements have surpassed its organic capacities, and the DoD has had to lease commercial services. In addition to the limited capacities of the DoD wideband communications satellites themselves is the limited U.S. military ground station capabilities, both fixed and tactical.

Fixed Satellite Communications Sites

The two ground elements of a DoD satellite communications link during a contingency operation are the forward-deployed ground terminals and the fixed reachback sites. Currently, there are nine standardized tactical entry points (STEPs) providing reachback connectivity to the Defense Information Systems Network (DISN), the military's portion of the global information grid (GIG). STEPs are satellite terminals and associated communications processors that receive transmissions from DoD satellites and retransmit them, usually via fiber optic cable circuits or other satellites, to the Continental United States (CONUS) or fixed installations abroad. Plans are underway to upgrade these STEPs to give them commercial wideband satellite capabilities as part of the DoD Teleport proposal.[4] DoD is improving its capability to efficiently utilize commercial wideband satellite communications, and the commercial vendors have capacity available.

RAND recently estimated the maximum commercial capacity available at each of the DoD STEPs from the Columbia, Orion, PanAmSat, and INTELSAT/New Skies satellites. The detailed data is shown in Figure 3. Generally, this information indicates that elements of the commercial satellite communications market could provide a significant capability to deployed U.S. forces via these STEP sites, assuming they are upgraded to accommodate commercial frequencies. However, even if STEPs are upgraded in accordance with the Teleport program, "…capacity is still grossly inadequate to support projected requirements. After a $100 million effort per site [to achieve full Teleport capability], its capacity will still only be 0.39 Gbps, versus the conservative two MTW estimate of 35 Gbps in the year 2010."[5]

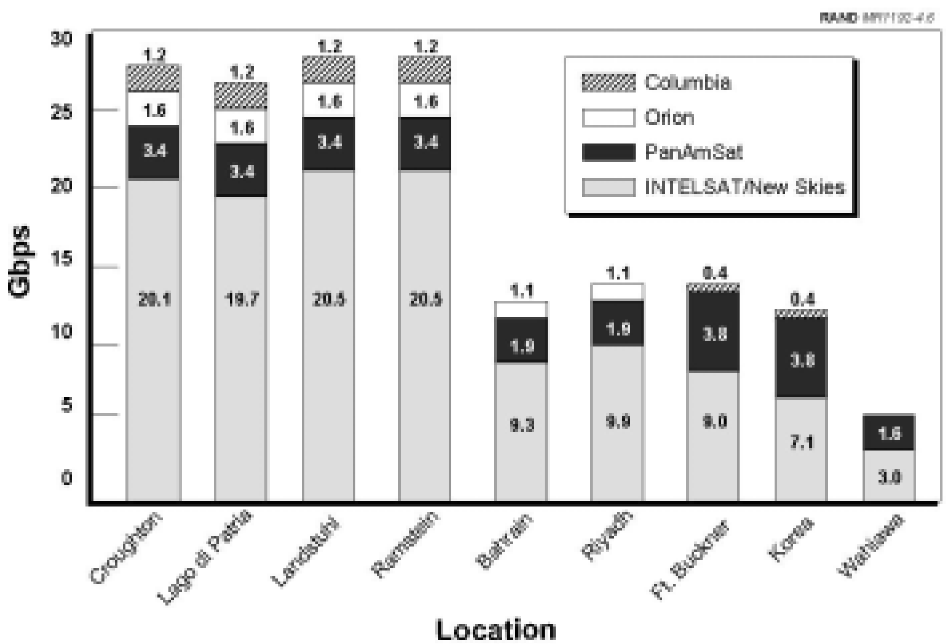

Figure 3 - Maximum International Satellite System Capacity Over DoD STEP Sites[6]

Over the past 7 years DoD has increased its emphasis on procuring tactical ground terminals capable of using commercial frequencies, greatly increasing its flexibility to provide wideband satellite services during contingency operations.

Tactical Satellite Communications Terminals

DoD has been investing heavily to buy new tactical satellite communications terminals to replace the 1970s vintage systems that continue even today to provide connectivity to deployed forces in Southwest Asia and Europe. These new systems are not only much more capable than the old ground mobile forces (GMF) terminals, but are also about one-eighth the size and weight.

These new systems are designed to provide more than twice the bandwidth capacity of the old GMF equipment, be capable of operating on two satellites simultaneously, able to use traditional military X-band frequencies, plus commercial C- and Ku-bands, with dual-use (commercial and military) Ka-band upgrades in development. Ka-band capability will be employed on the Wideband Gapfiller Systems discussed in Chapter 2.[7]

It should be evident that DoD is making strides toward being able to better utilize commercial wideband satellite communications services by fielding more advanced equipment. A bigger problem is the disjointed processes currently being used by many DoD entities charged with coordinating satellite communications support for contingency operations. Also, from a strategic and operational perspective, what is lacking is a corporate government strategy to find and fund the best methods to satisfy DoD warfighters' current and emerging wideband satellite communications needs.

Notes

[1]Honorable Donald H. Rumsfeld, *Report of the Commission to Assess U.S. National Security Space Management and Organization*, January 11, 2001, 74.

[2]Dr. Michael S. Frankel, *Report of the Defense Science Board Task Force on Tactical Battlefield Communications*, February 2000, available from http://stinet.dtic.mil/cgi-bin/fulcrum_main.pl, xi.

[3]Honorable Donald H. Rumsfeld, *Report of the Commission to Assess U.S. National Security Space Management and Organization*, January 11, 2001, 72.

[4]Tim Bonds, et al, *Employing Commercial Satellite Communications: Wideband Investment Options for the Department of Defense*, (RAND, 2000), 36.

[5]Dr. Michael S. Frankel, *Report of the Defense Science Board Task Force on Tactical Battlefield Communications*, February 2000, available from http://stinet.dtic.mil/cgi-bin/fulcrum_main.pl, 101.

[6]Tim Bonds, et al, *Employing Commercial Satellite Communications: Wideband Investment Options for the Department of Defense*, (RAND, 2000), 37.

[7]MSgt Mervin Applegate, HQ United States Air Forces in Europe Long-haul Transmission Branch (USAFE/SCMT), e-mail correspondence with author, Jan 2001.

Chapter 4

Commercial Wideband SATCOM Services Analysis

> *A strategic mix of mostly private sector telecommunications technologies and systems (leased or bought) combined with a smaller subset of DoD-unique systems integrated into a common-user DoD-wide Intranet must be the goal of the future. Today, this 'mix' happens on a crisis-by-crisis basis: Kosovo could and would not have been successful if we had not procured in real time, extensive private sector telecommunications services for DoD use in this contingency.*
>
> —Report to the Defense Science Board[1]

DoD requirements for satellite communications continue to grow each year, and there is no question it cannot satisfy its needs organically. Commercial wideband satellite communications are the answer, but what's the best way to procure those services, and who in DoD should take the lead in doing so? Both of these issues must be addressed successfully if the DoD is to be able to find a way to satisfy its communications requirements, especially in support of contingency operations.

Traditional Practices

Ad Hoc Leases

Historically the DoD has obtained emergency, short-notice wideband satellite communications services from commercial vendors on a strictly ad hoc basis. For example, during both Desert Shield/Storm in 1990-91, and the Kosovo operation in 1999, deployed warfighter requirements for robust wideband satellite communications quickly exceeded

available organic DoD capacity. Leased satellite services filled the void, but in each of these two cases, the average time to activate these links was on the order of 45-60 days.[2] This is a long wait, especially if the contingency environment is hostile.

According to a 2000 RAND study, the costs for ad hoc leases such as these in today's marketplace would be on the order of $5 million per week ($274 million per year) if leased weekly, or $3 million per week ($154 million per year) if leased in 90-day increments.[3] Of course, it is very difficult to accurately estimate the duration of a contingency operation. Furthermore, this simple analysis assumes a constant bandwidth requirement, which also cannot be accurately predicted. RAND built a database of contingencies during which ad hoc commercial satellite bandwidth was leased, and found that most lasted about 3 months long.[4]

Long-term Leases

Long-term leases are more cost efficient than ad hoc leases. From a traditional perspective, long-term satellite communications leases are from 1 to 15 years. For example, INTELSAT, one of the leading providers of commercial wideband satellite communications, leases the bulk of its capacity via long-term leases within this range.[5] In comparison to the ad hoc leases outlined previously, the below table shows the cost benefit of using long-term leases. Of particular note is the cost to purchase the whole satellite over 10 years is about 20 percent less than a 10-year lease. The projected cost to buy the satellite is $48 million, which, over a 10-year period, is 20 percent less than the cost of the lease.[6]

Table 1 - Lower Prices in Exchange for Longer-Term Commitments

Acquisition Method	Price (Gbps-Year)	Duration
Ad hoc transponder lease	$274 million	One week
Ad hoc transponder lease	$154 million	Three months
Long-term transponder lease	$77 million	One year
Long-term transponder lease	$58 million	Ten years
Satellite purchase	$48 million	Ten years

Source: Tim Bonds et al, *Employing Commercial Satellite Communications: Wideband Investment Options for the Department of Defense*, (RAND, 2000), 90.

Based on this analysis, why shouldn't DoD just buy more wideband communications satellites, instead of leasing services at costs ranging from 120 percent to as high as five times the purchase cost? One reason not to buy satellites is that the purchases require more up-front spending than do the leases. Also, although leased bandwidth may be available soon after the decision is made, buying a satellite could delay availability of services for upwards of 3 to 5 years. Finally, technology improvements will continue, so buying a satellite would hamper DoD's ability to leverage these new capabilities.[7] Therefore, there are tradeoffs to consider when analyzing these options.

A New Way of Doing Business

RAND conducted detailed demand simulations regarding costs for DoD to obtain more wideband satellite communications services than it needs to satisfy day-to-day demand, using the overage to create a pool to meet contingency needs. Based on this analysis, the optimum course of action is for DoD to procure a 10-year lease of 140 percent of expected requirements.[8] To further mitigate the costs of this proposal, DoD could allow commercial vendors to sublease the portion of the DoD leased capacity not immediately required, with the understanding that DoD can preempt the sublease if a contingency requirement occurs. This proposal would require

further research regarding legal concerns, international satellite communications demand, and commercial market transaction costs.[9]

Implementing this type of arrangement would provide DoD warfighters with highly responsive wideband satellite communications services for use during contingency operations. This capacity could also be used to support exercises that would help military communicators become better trained at providing wideband support via commercial satellites. This additional practice would improve the quality and responsiveness of services provided during actual contingency operations. Given these ideas on how to procure wideband satellite communications for DoD use, which DoD element should implement the proposals?

Centralized Command, Decentralized Execution

A core concept to conducting successful military operations is centralized control and decentralized execution.[10] As military commanders develop contingency plans, they must remember this concept, ensuring they do not plan a campaign that does not allow the leaders in the field the flexibility needed to maximize tactical successes. One tool commanders use to assist in this endeavor is effective communications, which is what Sun Tzu meant when he wrote, "To control many is the same as to control a few. This is a matter of formation and signals."[11] The JFC must establish his operational objectives, communicate his plans to the field units, and then rely on his leaders in the field to execute the tactical missions that will achieve these objectives.

A clear organizational structure helps enable the JFC to accomplish his operational objectives. Similarly, the United States' approach to its national security space program needs to be developed by a single entity, and implemented in a coordinated fashion by all appropriate

agencies. However, today's approach to space capabilities, especially from a DoD perspective, is quite disjointed and often unresponsive.

Who's Responsible for What?

Just considering the DoD elements, the following organizations have a large stake in the process that ultimately results in the deployed warfighter either getting the bandwidth he needs, or not: OSD/C3I, JCS/J6, DISA, USSPACECOM, combatant commander J6s, senior communicators at all Service headquarters, etc. Suffice it to say that there are a great many cooks in the kitchen, each with his own recipe and ability to affect the final taste of the meal. But once that meal is served, whether it tastes good or is filling, the recipient's ability to change what he gets is limited.

The process JFCs use to obtain elements of the communications enabling his forces needs to be revamped, or perhaps even discarded and a new approach developed. There is no doubt all the entities mentioned above want to provide the deployed warfighter what he needs to quickly, efficiently and effectively conduct his contingency operations downrange. An example of a unit providing exceptional warfighter support is the superb team of professionals at the Global SATCOM Support Center at Peterson Air Force Base, Colorado. Their dedication to serving their customers is superb, and they are working hand-in-hand with their counterparts in DISA to design and implement new, innovative methods of providing better support to their customers, especially the regional combatant commands.[12] However, there is much more work to be done. An example of another move in the right direction is DISA's Defense Information Systems Network Satellite Transmission Services-Global (DSTS-G) program.

Earlier this year DISA awarded military satellite communications contracts to three companies, and if all options are exercised, these contracts supporting the DSTS-G program are

worth nearly $2.2 billion, and are designed to help DoD respond to contingencies worldwide.[13] In this case DISA is exercising the type of leadership required to get DoD on the right track regarding its use of wideband commercial satellite communications.

Notes

[1]Dr. Michael S. Frankel, *Report of the Defense Science Board Task Force on Tactical Battlefield Communications,* February 2000; available at http://stinet.dtic.mil/cgi-bin/fulcrum_main.pl.

[2]James A. Winnefeld, Preston Niblack, Dana J. Johnson, *A League of Airmen: U.S. Air Power in the Gulf War*, (RAND, 1994), 210; Robert K. Ackerman, "Kosovo Maps the Future of Information Technologies," *Signal*, Dec 1999, available: www.us.net/signal/Archive/Dec99/kosovo-dec.html.

[3]Tim Bonds et al, *Employing Commercial Satellite Communications: Wideband Investment Options for the Department of Defense*, (RAND, 2000), 90.

[4]Ibid., 91.

[5]Ibid., 86.

[6]Ibid., 90.

[7]Ibid., 90, 94, 95.

[8]Ibid., 111.

[9]Ibid., 111, 121.

[10]Air Force Doctrine Document 2, Organization and Employment of Aerospace Power, 17 February 2000, 6.

[11]Sun Tzu, translated by Samuel B. Griffith, *The Art of War*, (Oxford: Oxford University Press, 1963), 90.

[12]The author visited the US Space Command Global SATCOM Support Center on Dec 18, 2000.

[13]George I. Seffers, "Satellite Services Deal Awarded," *Federal Computer Week*, Feb 16, 2001, available at http://www.fcw.com/fcw/articles/2001/0212/web-sat-02-16-01.asp, 1.

Chapter 5

The Road Ahead

> *...space is emerging as a military and economic center of gravity for our information-dependent forces, businesses, and society. Life on earth is becoming inextricably linked to space.*
>
> —USSPACECOM Long Range Plan[1]

Conclusions

Military wideband satellite communications systems cannot meet current or planned DoD requirements, now or in the future. However, there is sufficient commercial capacity available to meet all DoD requirements not currently serviced by organic DoD systems. The problem is that there is no concerted effort by the U.S. Government, or more specifically DoD, to take the aggressive actions necessary to harness this capability so desperately needed by the U.S. military warfighters of today and tomorrow.

If changes are not made quickly, the problem will continue to mushroom at an exponential rate, severely degrading the ability of DoD forces to conduct worldwide contingency operations. According to joint doctrine, "To ensure *the continuous and uninterrupted flow and processing of information*, joint warfighters must have C4 systems that are interoperable, flexible, *responsive*, mobile, disciplined, survivable, and sustainable [*emphasis added*]."[2] DoD cannot provide this continuous and uninterrupted service without increasing its access to responsive commercial wideband satellite communications satellite services. Failure to develop programs and

organizational structures to satisfy these requirements will eventually result in contingency operations during which the joint force commander is unable to obtain the level of communications service he requires. This shortfall will lead to the commander making decisions based on limited information, and will very likely result in prolonged conflicts and possibly unnecessary deaths.

Recommendations

> *If I always appear prepared, it is because before entering an undertaking, I have meditated for long and have foreseen what may occur. It is not genius which reveals to me suddenly and secretly what I should do in circumstances unexpected by others; it is thought and preparation.*
>
> —Napolean Bonarparte[3]

Now is the time for DoD to develop and implement a plan to meet its satellite communications needs, specifically by using commercial wideband satellite communications capabilities. There is no technical limitation to achieving this goal, but rather a lack of focus. "Despite the importance of the U.S. commercial and civil space sectors to the successful completion of the national security mission, the U.S Government has no comprehensive approach to incorporating those capabilities and services into its national security space architecture."[4]

"There is a very complex set of trade-offs that must be analyzed to establish the appropriate mix of commercial and DoD-unique telecommunications systems. DoD is not currently structured, nor does it have the independent resources, to conduct such an analysis."[5] As mentioned earlier, numerous studies have been accomplished documenting the military's requirement for satellite communications, and how to best utilize commercial services to help meet these needs. A final study needs to be conducted, with the expressed goal of determining

and implementing the best course of action to secure sufficient commercial satellite communications services for DoD use for the next 10 years and beyond.

To help ensure the best course of action is developed, a combined team of senior civilian and military communications leaders should be formed. As the recently published Space Commission report said, "The U.S. Government needs to develop a new relationship with industry to ensure U.S. space technological leadership."[6] The world's satellite communications marketplace is providing tremendous technological improvements that can provide the necessary increased capability DoD warfighters need.[7]

Concurrently as this study is undertaken, DoD leadership must convince Congress to provide the necessary funding to implement whatever course of action is chosen. Just as the GIG is a weapons system,[8] its foundation is a robust and capable communications transport network, of which wideband satellite communications is a key element. Therefore, this initiative must be properly resourced. Hard choices will be required, but failing to meet DoD's growing need for satellite communications services to support worldwide contingency operations could eventually result in battlefield defeats.

Suggestions for Further Research

Additional research should be undertaken to explore in more detail the increasing need for DoD to procure more commercial wideband satellite communications services. More specifically, issues such as protection of classified and sensitive information transiting commercial communications systems, guaranteed access to commercial satellite capacity during times of crisis, and how to best protect United States satellites using positive space control processes.

Additionally, in the long term, DoD must decide how to best structure the military departments to ensure space is used in the best and most efficient manner possible to maintain U.S. national security. As more and more commercial companies provide better and cheaper satellite services, state and non-state actors will gain capabilities that increase their ability to engage in asymmetrical attacks against U.S. interests.[9] It is imperative DoD not become complacent in a sense of false security regarding its dominance in space, as the gap between U.S. space capabilities and those of the rest of the world is continuously narrowing.

Notes

[1]*US Space Command Long-Range Plan*, March 1998, available on-line at http://www.peterson.af.mil/usspace/LRP.htm, 4-5.

[2]*Joint Publication 6-0, Doctrine for Command, Control, Communications, and Computer (C4) Systems Support to Joint Operations*, 30 May 1995, II-4.

[3]Air Force Doctrine Document 2, Organization and Employment of Aerospace Power, 17 February 2000, 85.

[4]Honorable Donald H. Rumsfeld, *Report of the Commission to Assess U.S. National Security Space Management and Organization*, Jan 11, 2001, available on-line at http://www.space.gov, 72.

[5]Dr. Michael S. Frankel, *Report of the Defense Science Board Task Force on Tactical Battlefield Communications*, February 2000, available on-line at http://stinet.dtic.mil/cgi-bin/fulcru_main.pl, xi.

[6]Honorable Donald H. Rumsfeld, *Report of the Commission to Assess U.S. National Security Space Management and Organization*, Jan 11, 2001, available on-line at http://www.space.gov, 40.

[7]Lt Gen John L. Woodward, USAF, JCS/J6, "Testimony to Congress, 8 March 2000, available on-line at http://www.house.gov/hasc/testimony/106thcongress/00-03-08woodward.htm, 40.

[8]Ibid., 4.

[9]*A National Security Strategy for a New Century*, (The White House, December 1999), 12.

Glossary

ACC	Air Combat Command
AEHF	Advanced Extremely High Frequency
AWACS	Airborne Warning And Control System
BatPic	Battlespace Picture
C3I	Command, Control, Communications and Intelligence
C4	Command, Control, Communications and Computers
CAP	Combat Air Patrol
CAT	Crisis Action Team
CCAF	Community College of the Air Force
CENTAF	Central Command Air Forces
CENTCOM	Central Command
CINCCENT	Commander-in-Chief Central Command
CJCS	Chairman, Joint Chiefs of Staff
C/JSOTF	Coalition / Joint Special Operations Task Force
CNN	Cable News Network
CONUS	Continental United States
CVBG	Carrier Battle Group
DoD	Department of Defense
DISA	Defense Information Systems Agency
DISN	Defense Information System Network
DSCS	Defense Satellite Communications System
EUCOM	European Command
EW	Electronic Warfare
Gbps	Gigabits per second
GCC	Gulf Cooperation Council
JCS	Joint Chiefs of Staff
JFACC	Joint Forces Air Component Commander
JFC	Joint Forces Commander
JFCOM	Joint Forces Command
JSOTF	Joint Special Operations Task Force

MilSatCom	Military Satellite Communications
MTW	Major Theater War
NEO	Noncombatant Evacuation Operation
NMCC	National Military Command Center
NSC	National Security Council
OPCON	Operational Control
Ops Center	Operations Center
OSD	Office of the Secretary of Defense
PACOM	Pacific Command
SATCOM	Satellite Communications
SECDEF	Secretary of Defense
SIPRNET	Secure Internet Protocol Network
SOCCENT	Special Operations Command Central Command
SOCOM	Special Operations Command
SOUTHCOM	Southern Command
SPACECOM	Space Command
STE	Secure Telephone Equipment
STEP	Standardized Tactical Entry Point
STRATCOM	Strategic Command
TACON	Tactical Control
TRANSCOM	Transportation Command
U.S.	United States
USA	United States Army
USAF	United States Air Force
USCINCCENT	United States Command-in-Chief Central Command
USSPACECOM	United States Space Command
UAV	Unmanned Aerial Vehicle
VTC	Video Teleconference
WGS	Wideband Gapfiller System

Definitions

AC-130. The United States Special Operation Command's high-powered gunship. Basically a heavily modified C-130 aircraft with a 105mm Howitzer artillery gun, 40mm cannons, and 25mm machine guns, employed to provide highly accurate close air support for friendly ground operations.

AWACS. "Airborne Warning and Control System" term usually applied specifically to the United States Air Force's E-3 command and control platform, used for controlling combat airspace during contingency operations.

B-2. The United States Air Force's premier long-range, strategic bomber, capable of flying non-stop bombing missions worldwide.

Bandwidth. Common description of communications transmission capacity, analogous to water flow through a hose. For example, a firefighter's 3 inch hose has more (bandwith) capacity than a basic half-inch garden hose.

BatPic. "Battlespace Picture" term created by the author to represent the capability of fully integrated, fused picture of the battlespace. This would include any type of imagery (infrared, electro-optical, radar) from any collection sensor (satellite, UAV, human, still/video camera, etc), plus additional information from intelligence analysts, or any other source deemed appropriate by the JFC.

CAP. "Combat Air Patrol" is basically fighter escort packages employed to provide defensive counter air protection for high-valued assets, such as AWACS or air refueling tankers.

CV-22. Not yet in the DoD inventory; undergoing test and evaluation. Tilt-rotor aircraft that takes off and lands like a helicopter, and then transitions to conventional fixed-wing flight operations. Capable of delivering fully equipped combat soldiers across great distances, will be used primarily for limited force entry missions, covert operations, and search and rescue missions.

EA-6B. Electronic Warfare aircraft flown by the Unites States Navy and Marines, designed to provide electronic spectrum escorts for interdiction missions. Conducts electronic surveillance and jamming to protect friendly aircraft from being acquired and engaged by enemy air defense systems.

Gbps. Gigabits per second is a commonly used measurement standard for high-speed communications. 1 Gbps means a communications transmission of 1 billion bits per second. Satellite communications capabilities are usually discussed using Gbps terminology.

Geosynchronous. The type of satellite orbit, roughly 22,500 miles above the earth, in which the satellite remains over the same point on the earth, because it is travelling at the same rate as the earth's rotation. Most communications satellites providing wideband (high bandwidth) services are in geosynchronous orbit.

Narrowband. Usually used to mean low-speed (low bandwidth) communications, including single-channel capabilities.

SDD. "Soldier Digital Device" term created by the author. Basically a multi-use communications device, capable of providing voice, data (including still and motion video), and other information support for the individual soldier.

SIPRNET. "Secure Internet Protocol Network" is basically the DoD's secure Internet, up to the Secret level. For example, it supports web surfing, electronic mail, file transfer, video teleconferencing, etc.

Wideband. Communications that are high bandwidth, such as in the Gbps range. Most often refers to multi-channel communications links.

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